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Kenaf Productivity and Morphology. When Grown in Iowa and in Kentucky. Poster Number

Marie Bourguignon
Iowa State University, marieb@iastate.edu

Kenneth J. Moore
Iowa State University, kjmoore@iastate.edu

Andrew W. Lenssen
Iowa State University, alenssen@iastate.edu

Sotirios V. Archontoulis
Iowa State University, sarchont@iastate.edu

Ben M. Goff
University of Kentucky

See next page for additional authors

Authors
Marie Bourguignon, Kenneth J. Moore, Andrew W. Lenssen, Sotirios V. Archontoulis, Ben M. Goff, and Brian S. Baldwin

IOWA STATE UNIVERSITY
Department of Agronomy

Kenaf Productivity, Morphology, and Anatomy When Grown in Iowa and in Kentucky.

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[1] Agronomy Dept., Iowa State University; [2] Plant & Soil Sci. Dept., University of Kentucky; [3] Plant & Soil Sci. Dept., Mississippi State University

1 - BACKGROUND

- There is a growing interest in replacing petroleum-based materials with renewable materials.
- **Kenaf** (*Hibiscus cannabinus* L.) is an annual, dicot herbaceous crop, originally from Africa, that produces bast fiber in its stem (Fig. 1).
- Producing kenaf as a specialty crop in the Midwestern U.S. would provide a local source of this fiber for use in a number of manufactured products.

Figure 1: Kenaf grown in Boone, IA (Oct 3rd 2015; Photo Credit: Pedro Infante) and fiber composition of kenaf stem.

- Kentucky is a southern state generally warmer and wetter than Iowa, allowing Kentucky to have a longer growing season.
- **We investigated kenaf productivity and morphology of two kenaf cultivars under two management practices in Iowa and in Kentucky.**

2 - MATERIAL & METHODS

Experimental Design	
Year	2014, 2015
Location	Boone, IA; Lexington, KY
Variety	'Tainung 2', 'Whitten'
Seeding rate	18.5, 37.1 seed m^{-2}
Exp. Design	RCBD with 3 reps at each year × location
Rep. Measures	7 harvests at each year × location
Measurements and Analysis	
Productivity	Plant density, dry leaf and stem biomass, leaf area index (LAI)
Morphology	Leaf:stem ratio, stem height, diameter, core:bast ratio
Composition	C:N
Statistical analysis	ANOVA, 5% level of significance

Table 1: Description of the experimental design and the measurements of the study.

- 'Tainung 2' and 'Whitten' seeds were planted in 38-cm rows on June 10, 2014 and June 2, 2015 in Boone, IA (42°01'N, 93°46'W); and June 6, 2014 and May 26, 2015 in Lexington, KY (38°10'N, 84°49'W).
- Nitrogen fertilization was applied at a rate of 168 kg ha^{-1} in both locations.

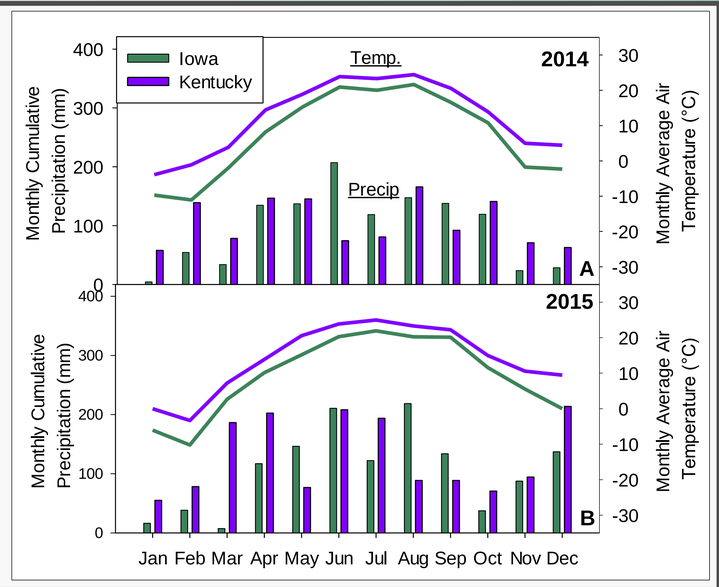

Figure 2: Monthly cumulative precipitation and average air temperature in Iowa and Kentucky, in 2014 (A) and 2015 (B).

3 - RESULTS

Objective 1: 'Tainung 2' and 'Whitten' productivity and morphology

- Kenaf productivity in Kentucky was overall higher than Iowa in 2014. But in 2015, both states reached a similar yield, mostly due to Japanese Beetle presence in KY.
- In 2014, 'Tainung 2' was performed better than 'Whitten' in Kentucky (Fig. 3-A).
- In 2015, 'Tainung 2' was more sensitive to management practices (seeding rate) than 'Whitten' (Fig. 3-B). Also, 'Tainung 2' had a higher core:bast ratio in Kentucky than in Iowa.

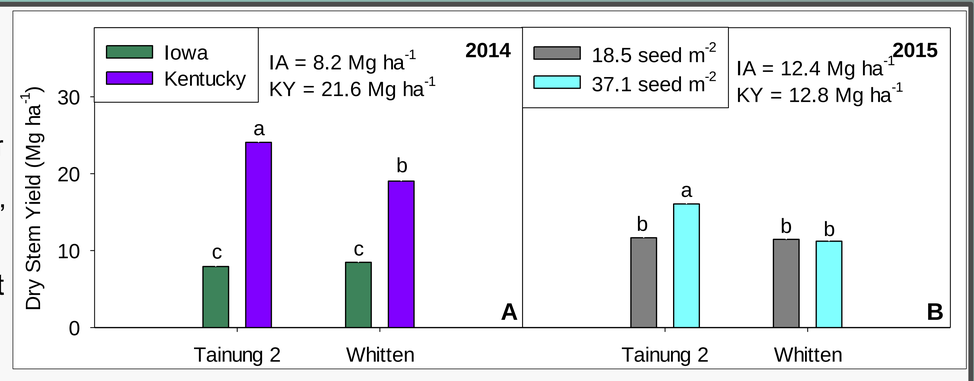

Figure 3: Yield per kenaf variety interacting with locations in 2014 (A) and with seeding rate in 2015 (B).

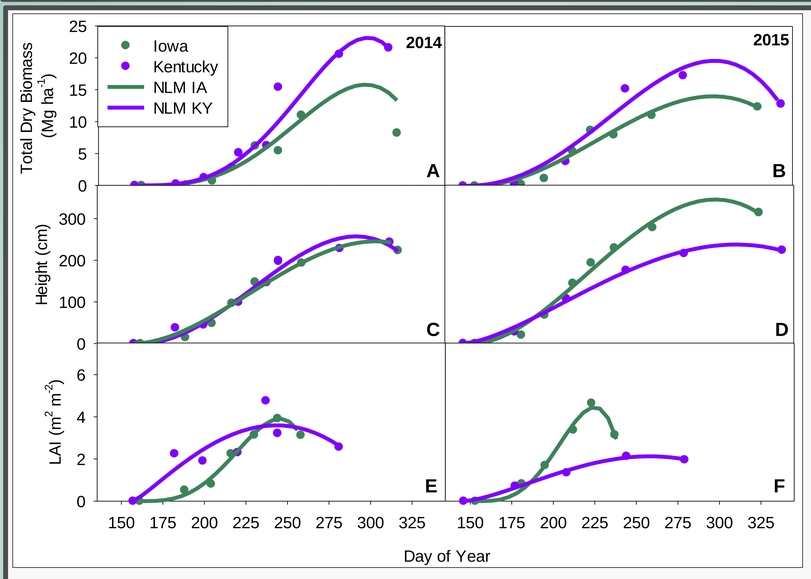

Figure 4: Dry biomass in both states in 2014 (A) and 2015 (B); stem height in both states in 2014 (C) and 2015 (D); and leaf area index (LAI) in both states in 2014 (E) and 2015 (F).

Objective 2: Assess kenaf growth over the growing season

- Kenaf growth, morphology, and physiology varied among states, but also among years (Fig. 4).
- The N dilution curve was drawn based in C:N measurements in both states and years (Fig. 5).

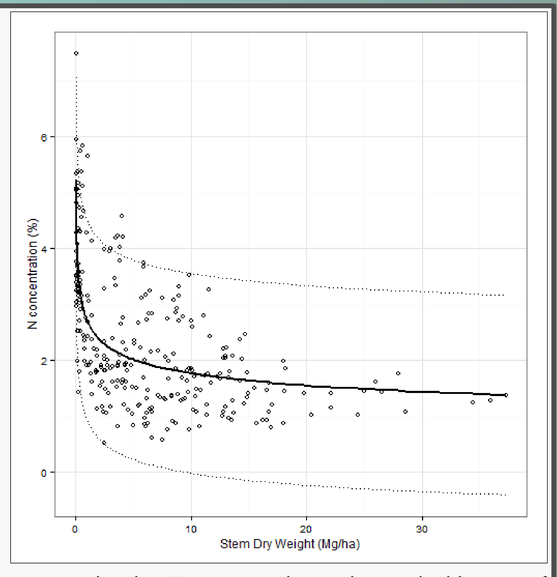

Figure 5: Nitrogen dilution curve, showing N concentration and stem dry biomass of kenaf grown in both states and years. The bold line represents the mean and the dotted line indicated the 95% C.I.

Objective 3: Determine variety and seed density effects on kenaf productivity and morphology.

- In Kentucky: Total dry biomass, core:bast ratio, and N concentration in the whole plant were sensitive to variety and seed density during the growing season.
- 'Tainung 2' planted at 37.1 seed m^{-2} reached the highest total dry biomass. 'Tainung 2' resulted in the tallest stem, during the whole growing season.
- In Iowa: The core:bast ratio was higher for the seeding rate of 37.1 seed m^{-2} and for 'Whitten'.

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4 - CONCLUSIONS

Overall:

- Kenaf productivity and morphology were affected by location, variety, and seeding rate, in different ways.
- Stem yield was higher in Kentucky than in Iowa in 2014, but kenaf productivity in Iowa was less variable over time, varieties, and seeding rates than in Kentucky.
- 'Tainung 2' was more productive than 'Whitten' in Kentucky; however, 'Whitten' was less sensitive to seeding rate.
- Kenaf in Kentucky was more affected by pests than in Iowa.
- Kenaf grown in Iowa remains vegetative compared to that grown in Kentucky, where flowered more than in Iowa. This could represent an advantage for producing kenaf in Iowa.